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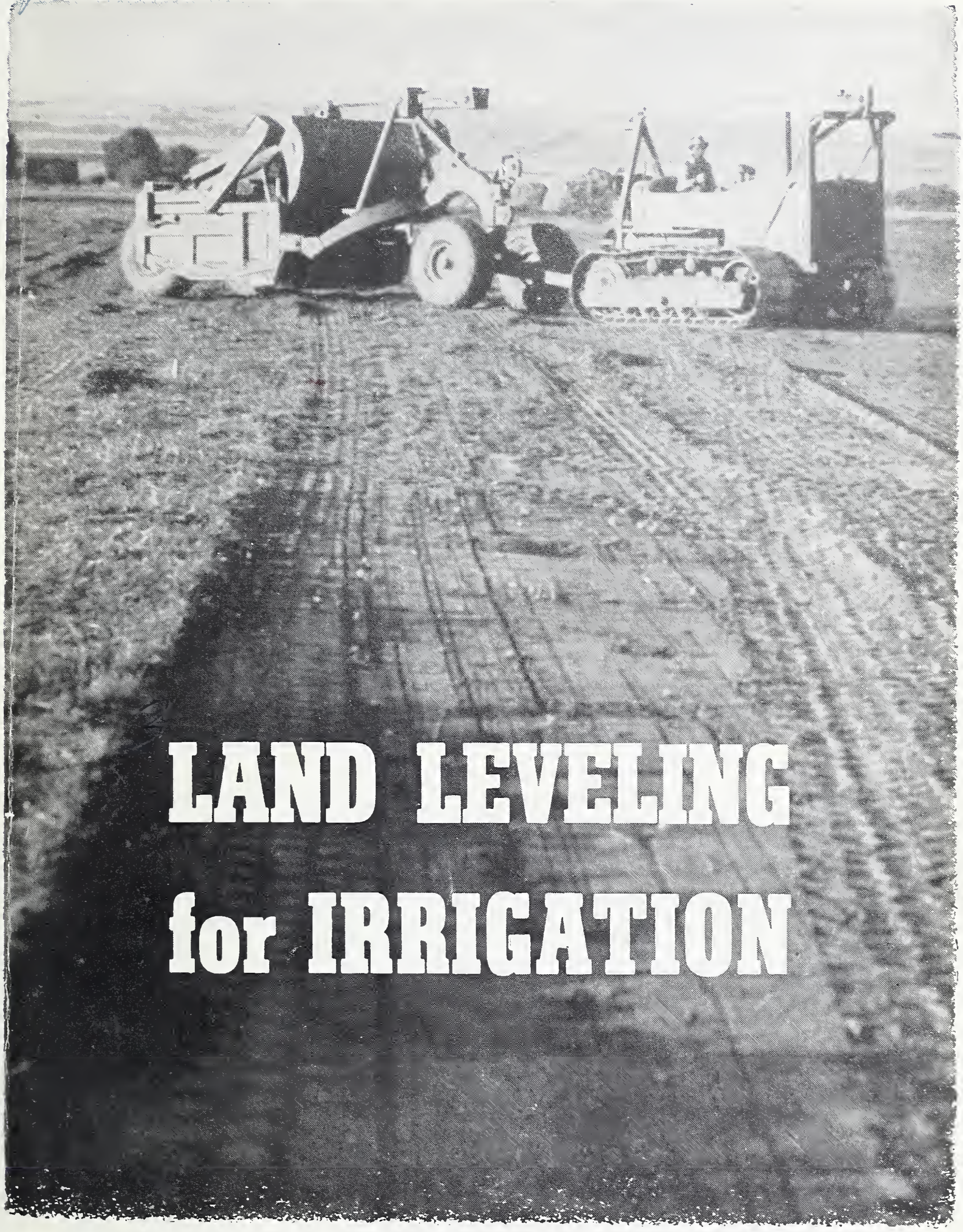

LAND LEVELING for IRRIGATION

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LAND LEVELING FOR IRRIGATION

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IF YOU ARE IRRIGATING land now, or plan to irrigate, your first soil and water conservation need may be to grade and smooth the land. This is commonly called land leveling. Generally you will not actually make the land level, but will grade the surface of the slopes.

Better irrigation will result from land leveling. You will gain through more nearly even crop stands, improved crop yields, and savings in irrigation water, labor, and other expense. These gains are in addition to preventing erosion and saving soil fertility.

Research workers in California and New Mexico learned that, on farms where irrigation with surface flow is not done efficiently, as little as one-fourth of the irrigation water put on the land goes into producing crops. Such waste is costly and may damage your land. Researchers at the Utah Agricultural Experiment Station showed that lack of a smooth surface is one of the major causes for the waste of water.

When you irrigate an uneven field, you water the high spots too little and the low spots too much. That alone is enough to make your crop uneven and reduce the yield. When you put too much water on a field you leach plant foods down out of reach of the plant roots. If the seeping water cannot escape through underground drainage, it raises the ground-water table, "waterlogs" the land, and eventually brings harmful salts to the surface. You probably have seen fields where this has happened.

The uniform grades that result from land leveling lets you organize your fields into irrigation runs of the right length. Then you are able to wet all of each field to the right depth—neither too little nor too much. You also can

The smooth surface of this leveled field permits uniform distribution of irrigation water. The ridges were built for border irrigation.

Even distribution of irrigation water in furrows on leveled land.

reduce, or even prevent, erosion during irrigation. When there is excess water on the surface from either irrigation or heavy rains, you can drain it off quickly and safely. This is important, especially in humid areas where there always is a possibility of a heavy rain soon after irrigation.

How much you can afford to spend on land leveling—or whether you can afford to convert to irrigation farming—will depend largely on the value of the crops you plan to grow. But don't forget to take into account also the saving in soil fertility, lower operating expense in irrigating, and the increases in yields to be expected. You probably will not do much land leveling if your water supply is not reliable. If your water supply is expensive, you may find you can afford to spend more money on land leveling in order to save water. If the job you plan is of this type, you may find it best to spread it out over several years.

You may decide to turn to sprinkler irrigation, for which you seldom will need to do land leveling.

Do the Job Right

Unless land leveling is done according to a good plan, you may not be helped much. Many farmers who now reap the benefits of good land leveling look back over the years of farming unleveled land and regret the waste of time, money, and water that it cost them.

You should do the land-leveling job that best suits the needs of your land. The depth and quality of your soil may limit what you can do. On shallow soils that are very rolling and irregular, you may be limited to the removal of only some of the higher spots. Or you may have to divide your field into two or more parts, each graded in different directions.

On the other hand, you can do a good land-leveling job on rather shallow soil if the slope is gentle and the surface already nearly smooth. Or, your soil may be deep enough for deep cuts. Where this is the case on fairly steep slopes, you could do land leveling in strips or "lands" at different eleva-

Irrigation water cannot be applied uniformly to unleveled or poorly leveled land.

tions across the natural slope. This is known as bench leveling.

Cost of Leveling

Land-leveling costs vary so much from place to place that a general statement about it has little value.

You might contract a land-leveling job at a price per acre or at a price per hour of equipment use. Another way is to make a contract on the basis of the cubic yards of soil moved. You can get the cubic-yardage figure from the engineer who drew the plans.

You may decide to do the work with your own equipment. Estimates of such costs often are much too low. Many count only the cash paid out. They do not add the interest on their investment in equipment and the cost of depreciation and maintenance, or the value of their time. These items all have an actual cash value.

Records from land leveling on 81,000 acres in 4 Western States—Arizona, Colorado, New Mexico, and Utah—give you some idea of the cost of such work. On this land, the average cost was 12.3 cents per cubic yard of earth moved.

It appeared from the records that small, light equipment powered with farm tractors could do the land leveling as cheaply per cubic yard as big, heavy equipment. Nor was there any real difference in the cost figures for jobs which had been done by contractors, rented equipment, or the farmer's own equipment.

Don't Level by Eye

Many fields appear smooth but are too uneven to apply irrigation water uniformly. So, you may be fooled if you judge whether a field needs land leveling just by looking at it.

If you are irrigating now, there are signs to show that your land needs such work. They are: (1) Water does not run down a furrow or border strip at a uniform rate of speed; (2) water is deeper on one side of a border strip than on the other; (3) water ponds up at places; (4) water breaks over furrows; (5) some parts dry out before the rest of the field, or stay wet longer; (6) small streams move soil downslope.

Accuracy is needed in land leveling. Planning the layout takes the use of surveying instruments in the hands of skilled people. In general, the grade should not be more than 6 to 8 inches fall in a distance of 100 feet. Some of the most satisfactory fields are now being laid out on grades of 3 inches or less fall in 100 feet.

Where surface drainage is no problem, you can make some fields truly level (0 slope). Bench leveling, for example, is usually done this way. So-called level irrigation reduces the waste of irrigation water, but you must put on the land only what is needed because none flows off, as from a sloping field.

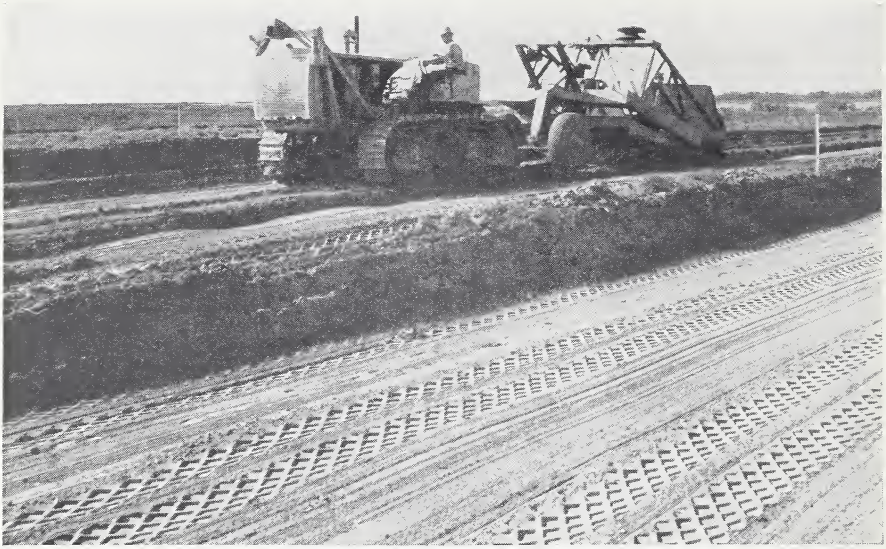
Surveys

You should have a soil survey made before doing any land leveling. The map the soil surveyor makes shows the nature of the surface soil, subsoil, and the material under the subsoil. It also shows the depth to sand, gravel, caliche, rock, or other materials that might limit the depth of cut you can make in land leveling, and the size of such areas.

Cuts into some kinds of subsoil will not be harmful. You can add organic matter and fertilizer to such places and build them up quickly. But in some places, cuts needed to shape the surface would be into material which will not grow crops. Even so, you may have to make a few small cuts into such material in order to get irrigation water to good land. Where this must be done, it usually would be wise to cut into the unproductive soil a foot deeper than needed, and then place a foot of good soil on the cut.

From the survey you can tell how fast the soil will take in water and how well it will hold it. The lengths of irrigation runs, and how long you will have to keep water on the land to wet it to the necessary depth, depend on the kind of soil.

The surface may be too uneven or the depth of soil too shallow for all of a field to be land leveled, or graded, in one direction.



Where the slope is too steep for irrigation with the slope, land leveling may be done in "lands" on the contour. This is bench leveling.

Field Layouts

In designing a land-leveling job, you and the engineer must consider all the physical factors. Chief among them are: (1) depth and characteristics of the soil, which may control the depth of cut; (2) land slope, which influences irrigation grades, direction of irrigation, and method of irrigation; (3) surface irregularities, which influence the division of a field into smaller fields or benches; (4) water supply, which influences lengths of runs, irrigation grades, widths of border strips, and sometimes the method of irrigation; (5) crops to be grown, which may determine the method of irrigation; (6) your likes and your equipment.

Cut-and-fill stakes are set after the design is made and the amount of earthwork and its cost are estimated. They guide the equipment operator or contractor who does the work. The stakes are usually set 50 to 100 feet apart for field leveling, and along each boundary for bench leveling.

You need a record of the engineer's estimates, and so does the contractor if the job is contracted. It's a good idea to prepare brief, written specifications and have a written agreement with the contractor.

Since you cannot change land-leveling jobs easily, once they are done, make sure beforehand that the layout fits the needs of your land, your cropping system, and your equipment. Get the best advice available.

Construction

You need both the right kind of equipment and an experienced, skillful operator to get a good land-leveling job done at reasonable cost. Tractor-drawn or motor-driven, but not necessarily large, equipment is usually the best.

The carryall is an efficient machine for land leveling. It cuts to grade, spreads the earth evenly, and hauls earth cheaply for fairly long distances. Smaller wheeled scrapers, which can be used with farm tractors, are coming into more common use for land leveling.

They will move earth about as cheaply as large equipment, but it does take more time to do the work with them.

If you do the work yourself with your own equipment, you avoid paying out cash to contractors or for equipment rentals and operators. But you must learn to be a skillful operator in this type of work.

Land-leveling jobs are finished with landplanes, levelers, or floats. The landplane has 4 wheels and an adjustable blade at about the center of the frame. This machine's great length—at least 60 feet—makes it possible to do the smoothest finishing job, but large tractors are needed to pull it.

The two-wheeled automatic-type leveler is also used for fine leveling. It is smaller than a landplane and also has a movable blade at about the center of the frame. You can power it with a medium-size farm tractor.

The common wooden float or drag is found in many different designs. Shorter than the other two types of levelers, it does not do as good a job of finishing.

Have the work checked from time to time during construction, and always have a final check after the job appears to be finished but before the equipment is moved off the field.

Take a year or two to give your newly leveled land the final touches. You ought not to plant longtime crops, such as alfalfa, immediately after leveling because the fills will settle somewhat and the soil in cuts may swell under irrigation. Instead, plant an annual crop the first year. When this crop has been removed, you can fill low spots with a float or drag. Then you can put the field into final shape before you plant a crop that will be there for several years.

You will need to do some maintenance work every time you prepare a seedbed in order to keep the surface smooth. This usually is done with a two-wheeled automatic-type leveler or a float.

Keep Informed

The cost of land leveling should be reason enough to have a good plan and follow it carefully. There is no better

A field as it appeared before land leveling. Surface is only slightly uneven, but it is uneven enough to make impossible the uniform distribution of water flowing on the surface.

Landplanes, which are the longest equipment, do the best finishing job in land leveling. Large tractors are needed to pull them, however.

way for you to become fully familiar with the conservation plans for your land—and development of a good irrigation system is a conservation measure—than to work right along with the technicians who may be helping you.

It is best to work with the technicians from the very start. As the surveys are made, you can supply information about your land that may affect the final design of the land-leveling job. And by helping in some of the actual survey work, you speed the job and gain a clear understanding of why some things must be done.

While the design is being prepared, talk things over with the engineer. Finally, keep in touch with the contractor after construction has been started. Watch the work as it progresses, and be sure that the equipment is not moved from the field until the land-leveling job has been finished and checked.

Where You Can Get Help

If your land is in a soil conservation district, technicians of the Soil Conservation Service are available to help you with the soil survey, the plan, and the design, and to check the work. Private engineers are available in some areas to help with the design. The Board of Supervisors of the District—farmers or ranchers, themselves—can help you locate a satisfactory contractor, if you wish. Your county agent also can tell you where to go to get advice concerning your land-leveling problems and how to go about solving them.

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